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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification [4] : G06K 11/06, 9/22

A1

(11) International Publication Number: WO 85/ 00683

(43) International Publication Date: 14 February 1985 (14.02.85)

(21) International Application Number: PCT/US84/01086

(22) International Filing Date: 11 July 1984 (11.07.84)

(31) Priority Application Number: 514,992

(32) Priority Date: 18 July 1983 (18.07.83)

(33) Priority Country: US

(71) Applicant: NCR CORPORATION [US/US]; World Headquarters, Dayton, OH 45479 (US).

(72) Inventors: FILLIMAN, Mark, D. ; 541 Millstone Drive, Beavercreek, OH 45385 (US). GRANZOW, Robert, H. ; 1158 Lindsey Avenue, Miamisburg, OH 45342 (US).

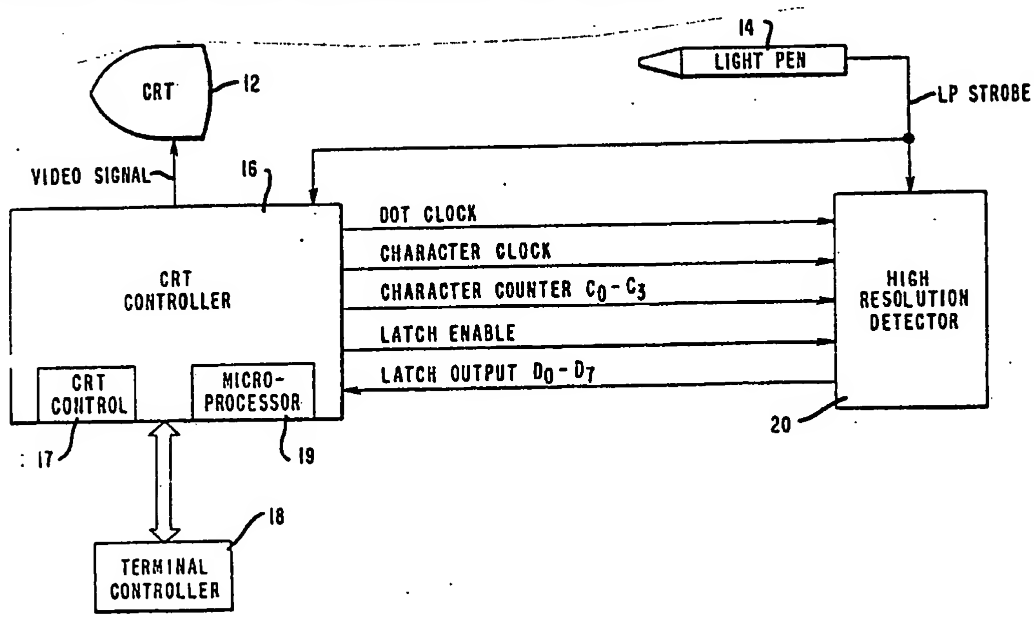
(74) Agents: SESSLER, Albert, L., Jr. et al.; Group Intellectual Property Counsel, Law Department, NCR Corporation, World Headquarters, Dayton, OH 45479 (US).

(81) Designated States: DE (European patent), FR (European patent), GB (European patent), JP.

Published

With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: PERSONAL IDENTIFICATION METHOD AND APPARATUS



(57) Abstract

In a method and apparatus for generating and storing personal identification information, a person moves a light pen (14) over a CRT screen (12) in a pattern corresponding to his signature. A CRT controller (17) provides a representation of a coarse, character position and a high resolution detector (20) including a counter (24) which counts pulses in synchronism with dot positions, provides a representation of a fine position for the light pen (14). The coarse and fine representations are combined and the resulting data is averaged and compressed to provide a vector representative of the signature, which is stored. A visible trace of the signature may be produced on the CRT screen (12). In a alternative embodiment, a transparent image of the signature is first formed and the image is placed on the CRT screen (12) for tracing by the light pen (14).

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PERSONAL IDENTIFICATION METHOD AND APPARATUS

Technical Field

This invention relates to a method and apparatus for generating and storing personal identification information.

The invention has a particular application where the personal identification information is a personal signature or other handwritten information indicative of the identity of a person.

Background Art

U.S. Patent Specification No. 4,308,522 discloses a signature verification system wherein a signature is recorded on a force-sensitive surface provided with a record medium for receiving the signature. The signature information is thereby converted to an analog electrical waveform which is digitized, compressed and processed to derive a reference vector for use in verifying the identity of a person.

Disclosure of the Invention

According to one aspect of the present invention, there is provided a method for generating and storing personal identification information, characterized by the steps of: providing display means including a display screen and controller means; providing sensing means which is coupled to position resolving means; moving said sensing means over said display screen in a pattern corresponding to said personal identification information; utilizing said controller means to provide coarse positional information; utilizing said position resolving means to provide fine positional information; combining said coarse and fine positional information to provide high resolution positional information; and storing said high resolution positional information.

According to another aspect of the present invention, there is provided apparatus for generating and storing personal identification information, characterized by: display means including a display screen and controller means adapted to produce a controllable repetitive pattern of illumination on said display screen; sensing means adapted to detect illumination on said display screen and to provide a strobe signal in response to detected illumination, said controller means being coupled to said sensing means to receive said strobe signal and to provide coarse positional information regarding the location of said sensing means on said display screen; position resolving means including counter means controlled by said controller means and coupled to said sensing means to receive said strobe signal to provide fine positional information regarding the location of said sensing means on said display screen; and processing means adapted to combine said coarse and fine positional information to provide high resolution positional information regarding the location of said sensing means on said display screen.

In an exemplary mode of application of the method and apparatus according to the invention, a bank customer "writes" his signature by moving a light pen over a CRT (cathode ray tube) display screen in a pattern corresponding to his or her signature. Information representing such signature is stored. Subsequently, when the customer desires to effect a financial transaction, such as cashing a check, the bank teller causes the stored information to be retrieved and utilized to provide a corresponding display on a CRT screen. The bank teller then visually compares the handwritten signature with the displayed signature for identification purposes.

Brief Description of the Drawings

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram showing the hardware components of a personal identification system.

Fig. 2 is a schematic diagram of the high-resolution detector included in the system of Fig. 1.

Fig. 3 is a timing diagram showing the waveforms and relationships of various signals associated with the system of Fig. 1.

Fig. 4 shows a representative sample of data points seen by a light pen on a CRT screen.

Fig. 5 is a diagram showing the manner in which data generated by the system is used to produce vectors for displaying a representation of the reference indicia.

Fig. 6 is a flow diagram showing the process for generating data representative of reference indicia from information produced in the course of recording the signature or other indicia.

Fig. 7 is a flow diagram of the count combining subroutine which forms part of the process shown in Fig. 6.

Best Mode for Carrying Out the Invention

Referring now to the drawing, an illustrated embodiment of a personal identification system is shown in block form in Fig. 1. This system comprises a display device 12, which may be a cathode ray tube terminal (CRT) such as an NCR Model M190, manufactured by NCR Corporation, Dayton, Ohio; a sensing device 14, which may be a light pen, such as a Model LP-710 manufactured by Information Control Corporation, Los Angeles, California; a terminal 16 for controlling the CRT 12; a terminal controller 18, and a high-resolution detector 20.

The terminal 16 may be any one of a wide variety of types, such as, for example, a financial teller terminal which is capable of performing a number of different types of financial transactions. For purposes of the present invention, such a terminal would include a CRT control device 17, such as a Motorola 6845 semiconductor device, manufactured by Motorola Inc., Phoenix, Arizona, for controlling the CRT 12, and a microprocessor 19, such as an Intel 8085 semiconductor device, manufactured by Intel Corporation, Santa Clara, California, for exercising system operation control under programs to be subsequently described.

The high resolution detector 20 extends the resolution of the light pen detection system of a standard CRT controller, which can normally only detect the position of a light pen on a CRT screen within one CRT scan line vertically, and within one character position horizontally. For a standard CRT, this gives a vertical resolution of 350 scan lines and a horizontal resolution of 80 characters. This degree of horizontal resolution is not adequate for the capture of data for an identification signature or other identifying indicia.

The high resolution detector 20 enables the position of the light pen 14 to be detected within one dot horizontally. Assuming 8 dots per character, as in the illustrated embodiment, this increases the horizontal resolution from 80 positions to 640. Other numbers of dots per character (such as 9 dots, which would give horizontal resolution of 720 positions per line) may be employed if desired, but a value of 8 dots per character simplifies certain aspects of the system, such as the data compression algorithm.

Referring now to Fig. 2, the high resolution detector 20 includes a latch 22, which may be of type SN74LS374, manufactured by Texas Instruments Inc.,

Dallas, Texas; a dot counter 24, which may be of type SN74LS161, also manufactured by Texas Instruments Inc., and a reset pulse generator 26, which may be of type SN74LS221, manufactured by Texas Instruments Inc.

The operation of the system of Fig. 1 is based upon the operation of a standard CRT 12 and CRT controller 16, and will now be explained. Reference may be had to the waveforms of Fig. 3 for understanding of the relationships of the various signals.

During operation, the CRT 12 receives a video signal 30 from the CRT controller terminal 16. This signal instructs the CRT 12 to turn on and off each dot in each horizontal line on the screen of CRT 12. The terminal 16 generates the video signal by means of an internal dot clock (not shown) which clocks once for each dot signal sent to the CRT 12 in the video signal 30. Also included in the terminal 16 is a character clock (not shown) which maintains a character count, each character being represented by eight dots of a horizontal line.

The internal character clock generates a character clock signal 32 which changes from a low to a high logic level at the end of each 8 dot count. This signal is applied to one input of an integral AND gate in the reset pulse generator 26. A second input to the AND gate is connected over a 10K ohm resistor 25 to a plus 5-volt source of potential, and a third input to said AND gate is connected to a base reference potential, shown as ground. An additional input VCC of the reset pulse generator 26 is connected over a 10K ohm resistor 27 to a plus 5-volt source of potential.

The character clock signal 32 causes the reset pulse generator 26 to generate a reset signal 34 from its Q output which is applied to the reset terminal of the dot counter 24, to cause said dot counter to be reset at the end of each character.

The dot counter 24 also receives dot clock signals 36 from the internal dot clock in the terminal 16 and maintains a count of the number of dot clocks that have occurred within one character. The counter output signal 38 on lines Q_A-Q_D inclusive extending between dot counter 24 and latch 22 indicate which specific dot is currently being displayed on the screen of the CRT 12. When the dot counter 24 reaches the last dot in the character, it is reset, as described above, by the reset signal 34 from the reset pulse generator 26, and begins counting dots for the next character. The EP, LOAD and ET inputs of the dot counter 24 are connected together and over a 10K ohm resistor 23 to a plus 5-volt source of potential.

Inputs to the latch 22 include the signal 38 on lines Q_A-Q_D from the dot counter 24, a signal 40 on lines C_0-C_3 from the terminal 16, representing the character position on the CRT display line, a light pen strobe signal 42 and a read count or latch enable signal 44. The latch enable signal 44 is not drawn to the same time scale as the remaining signals in Fig. 3. Outputs from the latch 22 include the dot position signals 46 on lines D0-D3 and the low four bits of the character position signals 48 on lines D4-D7.

The latch 22 functions to store the current dot position when the light strobe signal 42 is applied to said latch. At such time, the latch 22 captures the value of the dot counter 24 and the low four bits of the character counter in the terminal 16.

A program for converting the above-described data into information representing the instantaneous position of the light pen on the screen of the CRT 12 controls the processing of real-time data from the light pen 14 and the high resolution detector 22. It is stored in the terminal 16 and operates the microprocessor 19 contained therein. This program is illustrated by the flow diagrams of Figs. 6 and 7.

As shown in Fig. 4, the real-time data which is captured by the hardware comprises a "burst" of about nine points or dots on successive lines of the screen of the CRT 12 where the light pen 14 has detected an energized phosphor dot. This burst is repeated each time that the entire CRT screen is refreshed in normal operation. It will be noted that the individual points X1-X9 inclusive of Fig. 4 are in a generally semicircular configuration, corresponding to the leading edge circumference of the circular detection area 49 of the light pen 14. The data captured for each of these points appears in Table 1 below, together with additional information developed therefrom, as will subsequently be explained in greater detail. It will be appreciated that the light pen 14 senses only one dot for each scan line because of its relatively slow operation.

TABLE 1
SAMPLE DATA FROM ONE
BURST (HEXADECIMAL)

POINT	CONTROLLER CHARACTER COUNT	DETECTOR CHARACTER COUNT	DOT COUNT	COMBINED COUNT	ROW	COLUMN
X1	0010	E	0	000E0	0	E0
X2	005F	D	6	005D6	1	D6
X3	00AF	D	3	00AD3	2	D3
X4	00FF	D	5	00FD5	3	D5
X5	014F	D	3	014D3	4	D3
X6	019F	D	0	019D0	5	D0
X7	01EF	D	4	01ED4	6	D4
X8	023F	D	6	023D6	7	D6
X9	0290	E	1	028E1	8	E1

Referring now to Fig. 6, the program first initializes the CRT screen and controls therefor, as

represented in block 50, to provide a stable CRT display with the full screen illuminated. The recording of indicia such as a signature is normally initiated, as represented in block 52, by pressing the light pen 14 against the screen to energize a pressure-responsive switch, or some other suitable control means.

The process continues as represented in decision block 54, by determining whether or not the light pen 14 has generated a strobe signal 42. When the light pen 14 detects an illuminated dot on the CRT screen, the strobe line generates a strobe signal 42 to cause the character count and the dot count for that individual dot to be latched in the latch 22 of the high resolution detector 20.

If no such signal has been generated, the process continues along branch 56 with the pen continuing to move on the screen until the end of the screen is reached, as represented by decision block 58.

However, if a light pen strobe signal is detected, the process continues on branch 60 to the "combine counts" subroutine which is represented in Fig. 6 by block 62, and which is shown in greater detail in Fig. 7, where a block 64 represents initiation of the "combine counts" subroutine.

As shown in block 66, the four low order bits C0-C3 of the controller count C, on lines C15-C0, taken from the terminal 16, are read and placed in an appropriate storage location associated with the microprocessor 19, contained in the terminal 16. In addition, the four low order bits D4-D7 inclusive of the character count are taken from the latch 22 of the high resolution detector 20 and are read and placed in a second storage location associated with the microprocessor 19. Also the four bits D0-D3 inclusive representing the dot count are read and placed in a third storage location.

It may be useful at this point to refer to Table 1 above, and to note that the character and dot values therein are expressed in hexadecimal notation. It may also be noted that due to the delay inherent in the CRT controller character counter, the CRT controller character count C is usually two counts later, and therefore greater in magnitude, than the detector character count D, which is in time with the corresponding detector dot count. Therefore, the subroutine of Fig. 7 must normally perform a corrective operation on the character count and then combine it with the dot count in order to produce the desired high resolution data which gives the precise location of the dot on the CRT screen which is currently being detected by the light pen 14.

To illustrate, reference may be had, for example, to point X3 in Table 1. The controller character count for X3 is 00AF (in hexadecimal notation). However, the low order (lines D4-D7 inclusive) character count from the detector 20 is "D", which is two counts, or bits, lower than the low order count (F) of the controller character count, due to the system delay, as mentioned above. Thus, the detector low order count "D" should be substituted for the controller character low order count "F" in order to correct the count. After this has been done, the dot count "3" is combined with the corrected character count in order to produce the "combined count" of "00AD3". This then can be translated by a look-up table or other suitable means to the row and column values of "2" and "D3" shown in the table to enable precise location of the dot on the CRT screen.

The point X9 of Table 1 offers another example, in which the controller character count is 0290 (in hexadecimal notation), and in which the low order character count from the detector 20 is "E", which is fifteen counts higher than the low order

count "0" of the controller character count. In this instance, in order to correct the controller character count, it is necessary to decrement the next-to-low order of the controller character count by one before substituting the low order detector character count "E" for the low order controller character count "0", and then combining this with the dot count "1" to produce the "combined count" of "028E1", which corresponds to the row and column values of "8" and "E1", respectively.

The process described above is represented in Fig. 7 by a continuation of the process from block 66, to the decision block 68, in which a comparison is made as to whether low order controller character count C is less than low order detector character count D. If so, then the next-to-low order of controller character count C must be decremented by one count, as represented in block 70, and as described above in connection with the dot X9. The process then continues to node 72.

If D is not greater than C, the process moves directly to node 72, and thereafter continues to block 74, in which the controller character count low order is replaced with the detector character count low order, as is also described above in connection with Table 1.

Following this, the process continues to block 76, in which the dot count is combined or concatenated with the corrected character count to produce the desired combined count. This ends the subroutine (block 78).

The continuation of the process is found in Fig. 6, in which a test is next made, as represented in block 80, to determine whether or not a given count is acceptable; that is, whether it is within defined parameters, and therefore presumed not to be the result of a spurious reading. In the illustrated

embodiment of the invention, this test involves a comparison of the values for each dot with the values of the first sensed dot of the burst. If the horizontal position of the dot being tested is to the right of the first dot, or is too far (more than a predetermined distance) to the left, then the dot being tested is not considered to be acceptable. This is consistent with the previously-described expected semicircular configuration of the dot burst. In the illustrated dot burst of Fig. 3 in Table 1, dots X6 and X9 are considered to be not acceptable.

Following the test of block 80, the process proceeds to node 82, after which a determination is made as to whether or not the end of the screen has been reached, as represented by previously-mentioned decision block 58. In the illustrated embodiment, this determination is made by using a software timer which times out after a duration equal to the time required for providing four scan lines on the CRT screen. If a light pen strobe occurs within that time period, then the process returns along branch 84 to the decision block 54.

However, if it is determined that the end of the screen has been reached, the process then averages the various dot information which has been received, as represented by block 86, to provide a single average dot location for the burst most recently detected. If the number of acceptable points in the burst is less than four, the entire burst is ignored in the illustrated embodiment. Otherwise, the rows and columns of the acceptable points are averaged. For the values shown in Table 1, the row average value is 3 and the column average value is 5.

The next step in the process is to compress the data from the average values for each burst, as represented by block 88. The compression algorithm compares the row and column information for the cur-

rent point with the row and column information for the previous point, and generates a series of short vectors between the points. One means of accomplishing this is by use of Michalski's vector generation algorithm, which is described on page 58 of the December, 1982 issue, No. 74, of Dr. Dobb's Journal.

Each of these vectors is represented by a 3 bit binary number determined by the orientation of the vector. This enables the division of an XY coordinate system into eight zones or octants, with each octant being defined by one of the available 3-bit combinations, as shown in Fig. 4. For example, if X_i represents the column value, and Y_i represents the row value, of a previous point; and if $X_i + 1$ represents the column value, and $Y_i + 1$ represents the row value, of a current point; and if $X_i + 1$ is greater than X_i and $Y_i + 1$ is greater than Y_i; and if the magnitude $| X_i + 1 - X_i |$ is less than $| Y_i + 1 - Y_i |$, then the orientation of the vector from X_i Y_i to $X_i + 1$ $Y_i + 1$ is in octant 1 of Fig. 5.

The series of 3-bit vector orientations define the path of the light pen 14 across the screen of the CRT 12 with a relatively small amount of data. Shortening of the vector length improves the accuracy of the trace of the path. As indicated in block 90, the vector information may, if desired, be fed back to the address inputs of the CRT screen for display of the signature or other identifying indicia on the CRT screen as said information is generated by movement of the light pen across the screen.

The process continues over branch 92 until the light pen is lifted from the screen, thereby causing an appropriate switching or other action, as represented by block 94. The compressed data representing the signature or other identification indicia is then transmitted to a suitable reference storage location, as indicated by block 96, and the process ends, as represented by block 98.

In an alternative embodiment of the invention, personal identification information such as a handwritten signature is initially recorded on a "one-time" carbon medium thereby providing a transparent image of the signature on an opaque background. The carbon medium containing the transparent image is then placed across the CRT screen 12 and the light pen 14 is passed over the transparent signature image. This arrangement has the advantage that personal signature information can be generated and stored without the need for the person providing the signature having to be present at the location where the CRT screen is situated.

CLAIMS:

1. A method for generating and storing personal identification information, characterized by the steps of: providing display means (12, 16) including a display screen (12) and controller means (16); providing sensing means (14) which is coupled to position resolving means (20); moving said sensing means (14) over said display screen (12) in a pattern corresponding to said personal identification information; utilizing said controller means (16) to provide coarse positional information; utilizing said position resolving means (20) to provide fine positional information; combining said coarse and fine positional information to provide high resolution positional information; and storing said high resolution positional information.

2. A method according to claim 1, characterized by the step of averaging a plurality of items of high resolution positional information which have been generated with said sensing means (14) in a single position to provide a single averaged item of high resolution positional information.

3. A method according to claim 2, characterized by the steps of collecting and compressing a plurality of said averaged items of positional information to provide a representation of the movement of said sensing means (14) over said display screen (12).

4. A method according to claim 3, characterized in that said step of combining includes the steps of: decrementing the penultimate denomination of the coarse positional information when the value of the fine positional information is less than

the low order value of the coarse positional information; and substituting the fine positional information for the low order of the coarse positional information.

5. A method according to claim 2, characterized by the steps of: testing each item of high resolution positional information in accordance with predetermined criteria to determine its acceptability; and discarding each such item which is found to be unacceptable.

6. A method according to claim 1, characterized by the steps of initially recording said pattern as a transparent image on a record medium, placing the record medium containing the transparent image on said display screen (12), and tracing the image path with said sensing means (14).

7. Apparatus for generating and storing personal identification information, characterized by: display means including a display screen (12) and controller means (16) adapted to produce a controllable repetitive pattern of illumination on said display screen (12); sensing means (14) adapted to detect illumination on said display screen (12) and to provide a strobe signal in response to detected illumination, said controller means (16) being coupled to said sensing means (14) to receive said strobe signal and to provide coarse positional information regarding the location of said sensing means (14) on said display screen (12); position resolving means (20) including counter means (22, 24) controlled by said controller means (16) and coupled to said sensing means (14) to receive said strobe signal to provide fine positional information regarding the location of said sensing means (14) on said display screen; and proces-

sing means (19) adapted to combine said coarse and fine positional information to provide high resolution positional information regarding the location of said sensing means (14) on said display screen (12).

8. Apparatus according to claim 7, characterized in that said processing means (19) is adapted to average a plurality of items of said high resolution positional information generated with said sensing means (14) in a single position to provide an averaged item of high resolution positional information, and to compress the averaged items to provide a representation of the movement of said sensing means (14) across said display screen (12) in the form of a series of connected vectors.

9. Apparatus according to claim 8, including storage means adapted to store said representation.

10. Apparatus according to claim 7, characterized in that said counter means includes a counter (24) responsive to clock signals provided by said controller means (16) and latch means (22) coupled to said counter (24) and adapted to receive said strobe signal.

11. Apparatus according to claim 10, characterized in that said controller means (16) is adapted to generate indicia on said display screen (12) corresponding to said stored representation.

12. Apparatus according to claim 10, characterized in that said coarse positional information is character position information, in that said fine positional information is dot position information, and in that said counter means includes reset

means (26) adapted to reset said counter (24) at the end of each character position.

13. Apparatus according to claim 7, characterized in that said display screen is a cathode ray tube screen (12) and in that said sensing means includes a light pen (14).

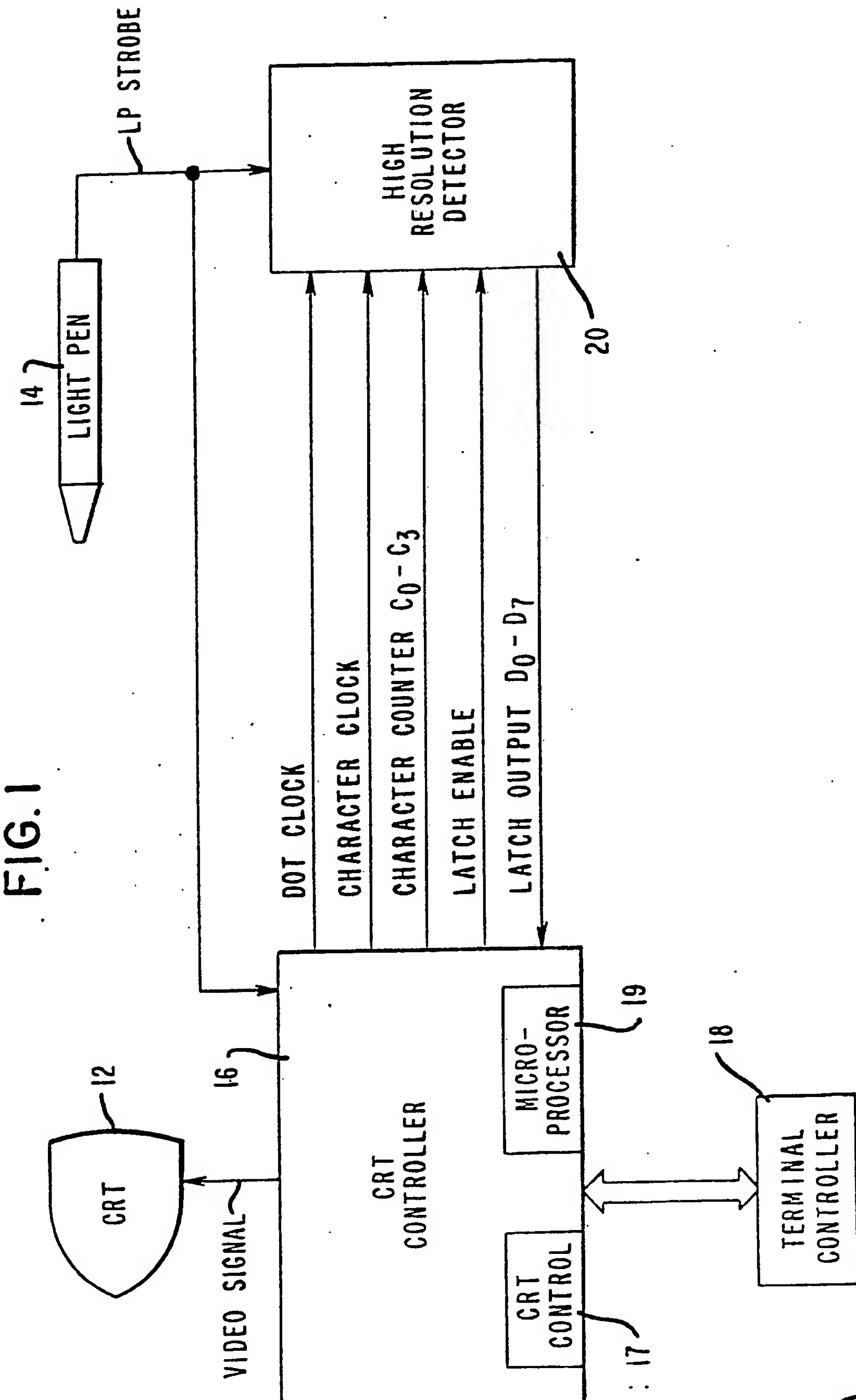
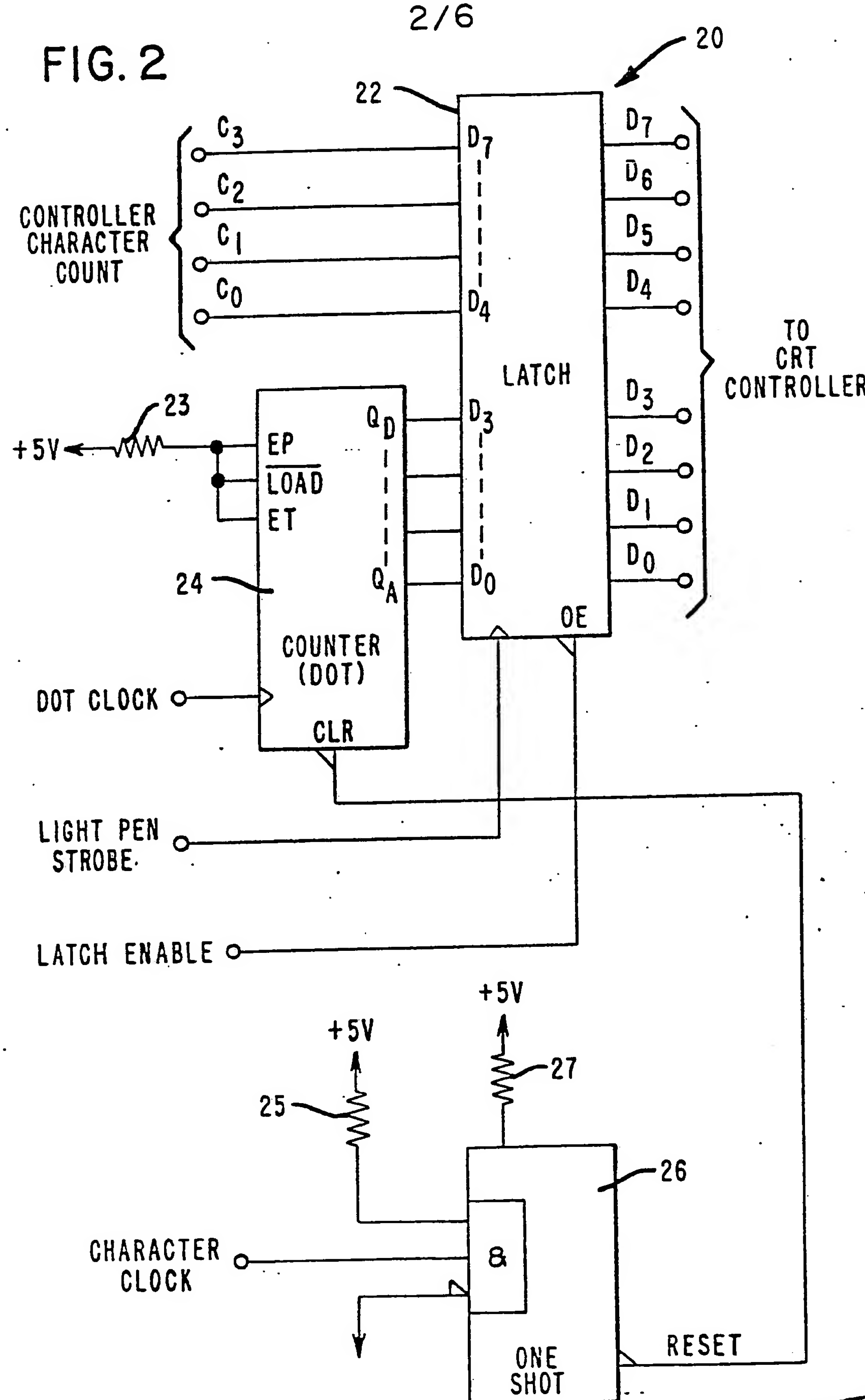

LP STROBE
HIGH RESOLUTION DETECTOR
20
LIGHT PEN
14
DOT CLOCK
CHARACTER CLOCK
CHARACTER COUNTER $C_0 - C_3$
LATCH ENABLE
LATCH OUTPUT $D_0 - D_7$
CRT CONTROLLER
16
MICRO-PROCESSOR
19
CRT CONTROL
17
TERMINAL CONTROLLER
18
CRT
12
VIDEO SIGNAL

FIG. 1

FIG. 2


20
22
LATCH
D_7
D_4
D_3
D_0
OE
C_3
C_2
C_1
C_0
CONTROLLER CHARACTER COUNT
D_7
D_6
D_5
D_4
D_3
D_2
D_1
D_0
TO CRT CONTROLLER
+5V
23
EP
LOAD
ET
Q_D
Q_A
24
COUNTER (DOT)
CLR
DOT CLOCK
LIGHT PEN STROBE
LATCH ENABLE
+5V
+5V
25
27
26
&
CHARACTER CLOCK
RESET
ONE SHOT

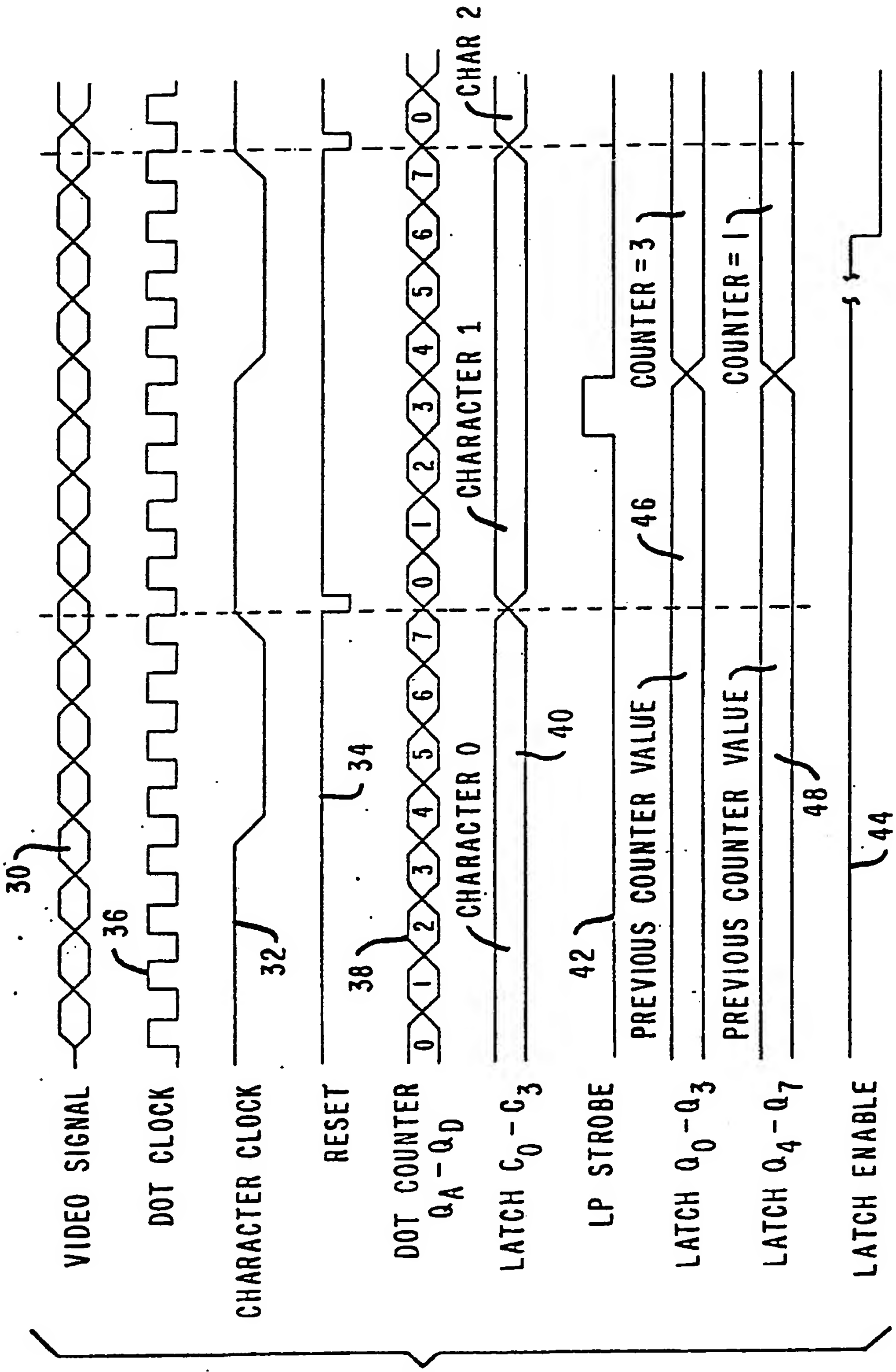

VIDEO SIGNAL
DOT CLOCK
CHARACTER CLOCK
RESET
DOT COUNTER $Q_A - Q_D$
LATCH $C_0 - C_3$
LP STROBE
LATCH $Q_0 - Q_3$
LATCH $Q_4 - Q_7$
LATCH ENABLE
30
36
32
34
38
40
42
44
46
48
0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0
CHARACTER 0
CHARACTER 1
CHAR 2
PREVIOUS COUNTER VALUE
COUNTER = 3
PREVIOUS COUNTER VALUE
COUNTER = 1

FIG. 3

FIG. 4

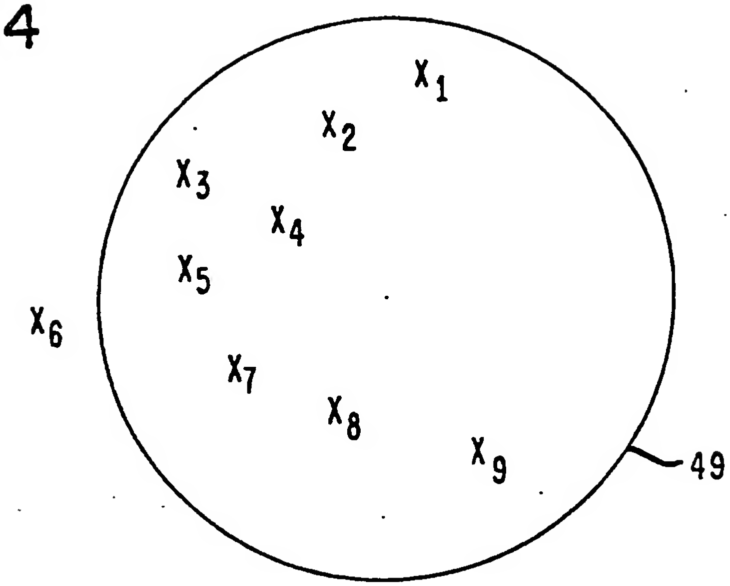
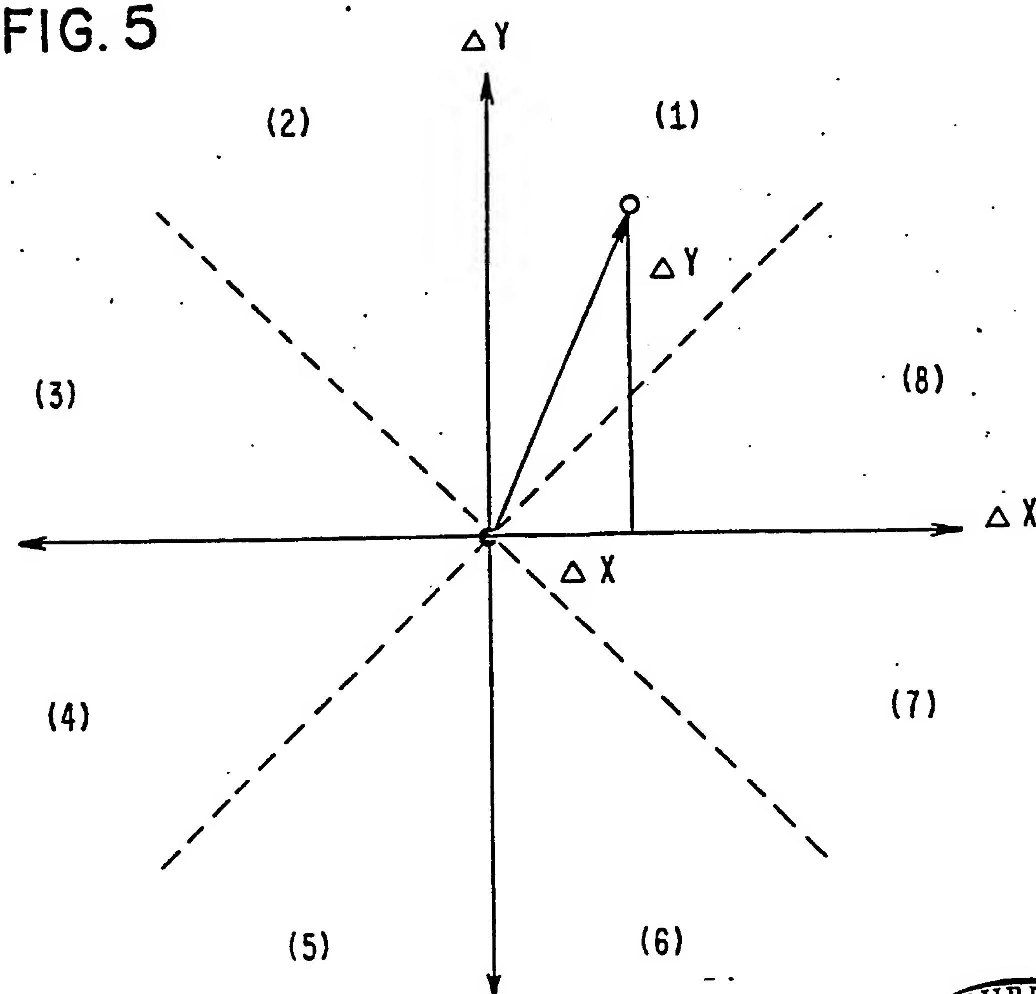


FIG. 5



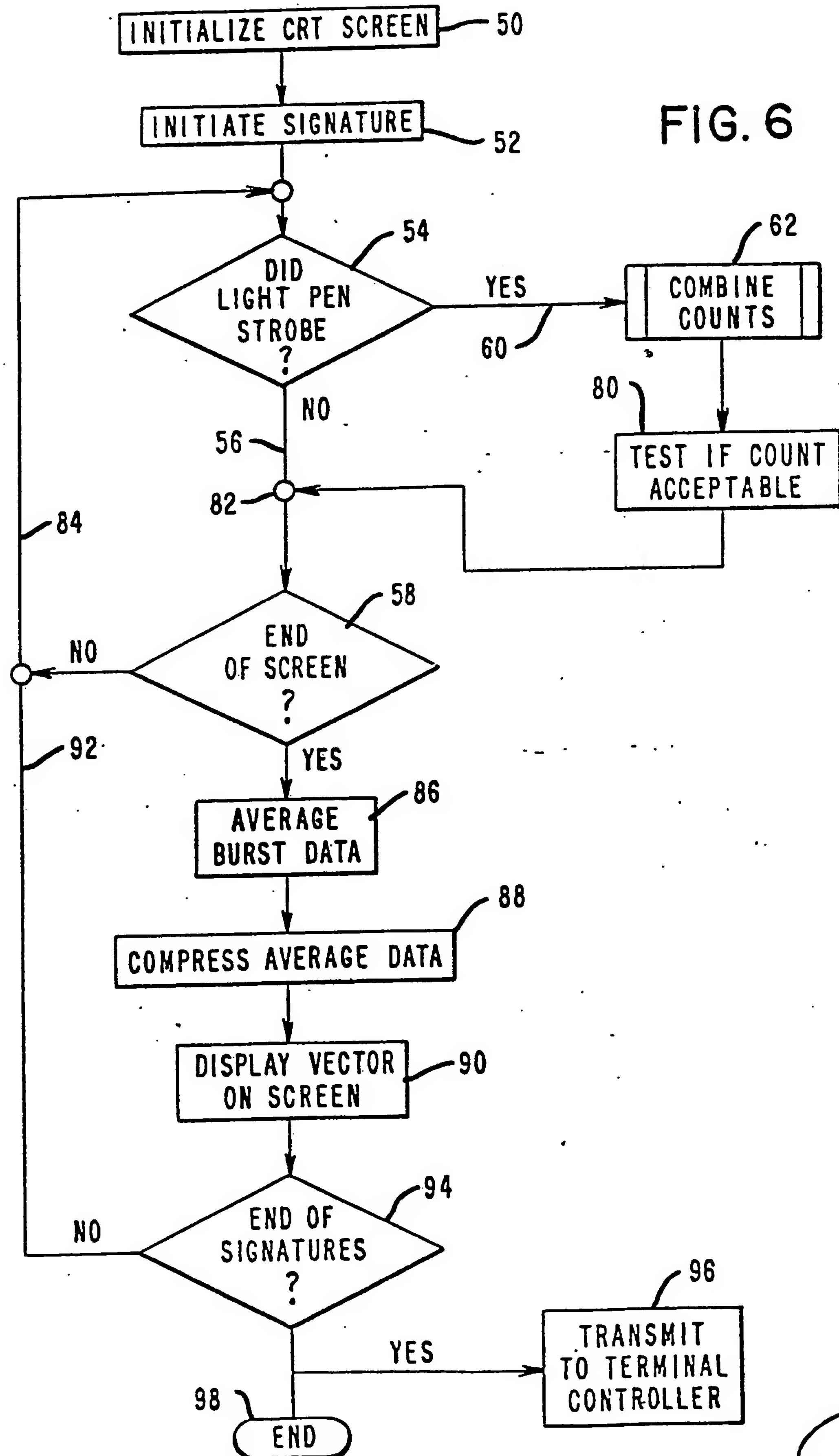
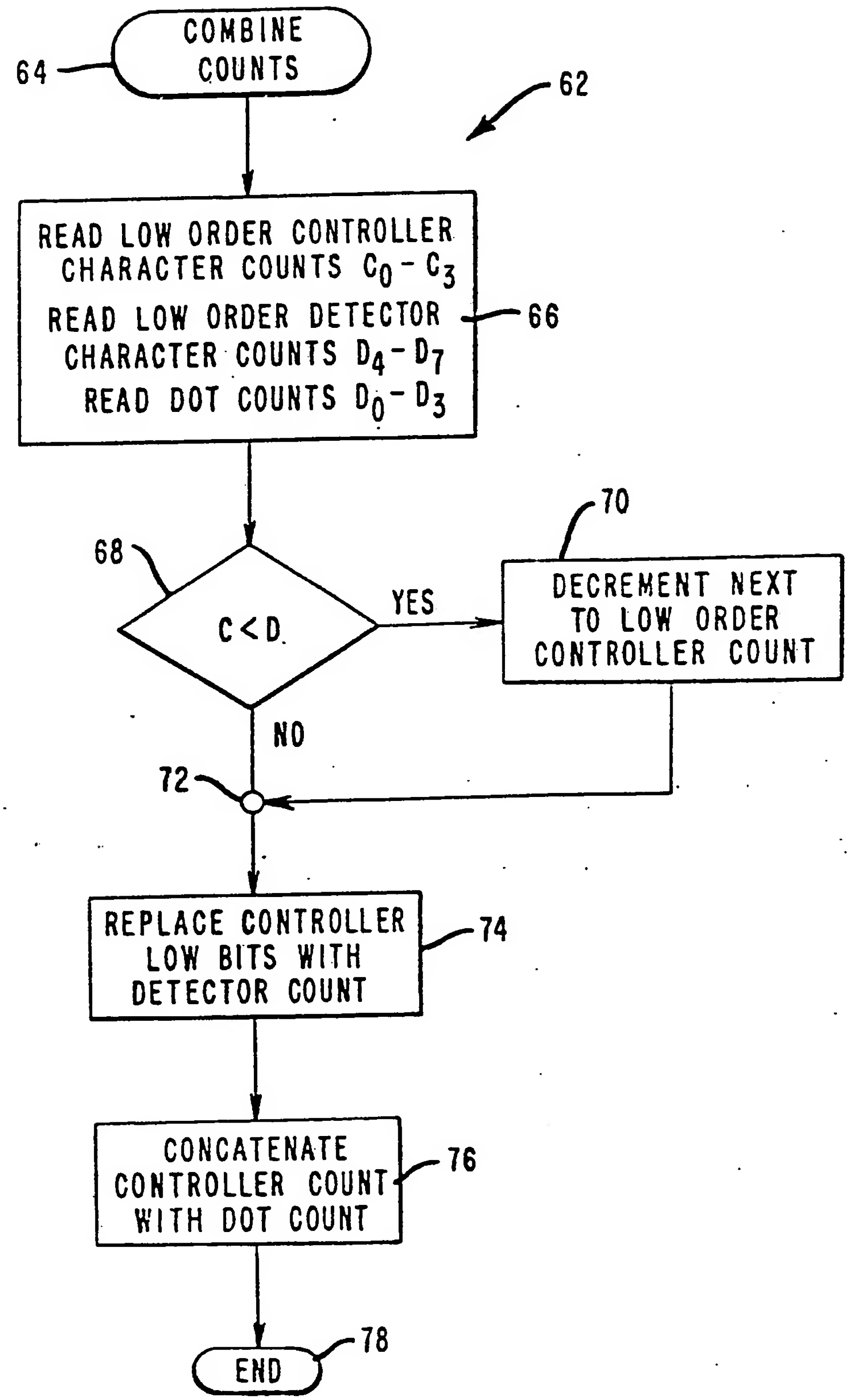

INITIALIZE CRT SCREEN
50
INITIATE SIGNATURE
52
54
DID LIGHT PEN STROBE ?
YES
60
COMBINE COUNTS
62
80
TEST IF COUNT ACCEPTABLE
NO
56
82
84
58
END OF SCREEN ?
NO
YES
92
AVERAGE BURST DATA
86
COMPRESS AVERAGE DATA
88
DISPLAY VECTOR ON SCREEN
90
94
END OF SIGNATURES ?
NO
YES
96
TRANSMIT TO TERMINAL CONTROLLER
98
END

FIG. 6

FIG. 7


COMBINE COUNTS
64
62
READ LOW ORDER CONTROLLER CHARACTER COUNTS $C_0 - C_3$
READ LOW ORDER DETECTOR CHARACTER COUNTS $D_4 - D_7$
READ DOT COUNTS $D_0 - D_3$
66
68
C<D
YES
70
DECREMENT NEXT TO LOW ORDER CONTROLLER COUNT
NO
72
REPLACE CONTROLLER LOW BITS WITH DETECTOR COUNT
74
CONCATENATE CONTROLLER COUNT WITH DOT COUNT
76
END
78

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 84/01086

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: G 06 K 11/06; G 06 K 9/22

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC[4]	G 06 K; G 06 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	US, A, 4112415 (HILBRINK) 5 September 1978 see figures 1,2,4; column 1, lines 27-58; column 2, line 65 - column 3, line 30; column 6, line 22 - column 7, line 27	1,7
Y		2,3,6,8,9-13
Y	Hewlett-Packard Journal, vol. 31, no. 12, December 1980 (Amstelveen, NL) F.J. Porter: "Light pen aids user interaction with display", pages 10-14,19; see figures 2,3,4; pages 11,12,13	2,3,8,9-13
Y	IBM Technical Disclosure Bulletin, vol. 12, no. 11, April 1970 (New York, US) K.C. Konnerth: "Graphical computer input", page 1875, see the entire article	6
A	Xerox Disclosure Journal, vol. 1, nos. 9/10, September/October 1976	./.

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
8th January 1985	04 FEV. 1985
International Searching Authority [1]	**Signature of Authorized Officer [20]**
EUROPEAN PATENT OFFICE	G.L.M. Kruydenberg

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, 16 with indication, where appropriate, of the relevant passages 17	Relevant to Claim No 18
	P.F. Evans: "Form-identification overlay", page 45, see the last five lines	6
A	GB, A, 2089180 (DATA GENERAL CORPORATION) 16 June 1982 see abstract; page 1, lines 5-96	2,7
A	US, A, 4146880 (ARIZABALAGA) 27 March 1979 see figures 1,3,4,5; column 1, line 60 - column 2, line 43	2,7,12,13
A	Wireless World, vol. 88, no. 1558, July 1982 (Sheepen Place, Olchester, GB) M. Shepherd: "A light pen for microcomputers", pages 30-32, see figures 1,2; pages 30,31	2,7,12,13